



DEPARTMENT OF TRANSPORTATION
HAZARDOUS MATERIALS REGULATIONS BOARD
WASHINGTON, D.C. 20590

[14 CFR Part 103]
RADIOACTIVE MATERIALS

Notice of Proposed Rule Making

CROSS REFERENCE: For proposed amendments to Part 103 of Title 14 of the Code of Federal Regulations, conforming with proposed amendments to 49 CFR Parts 170-190, see F.R. Doc. 68-695 (Docket No. HM-2; Notice No. 68-1), *infra*.

Hazardous Materials Regulations Board

[49 CFR Parts 170-190; 14 CFR Part 103]

[Docket No. HM-2; Notice No. 68-1]

RADIOACTIVE MATERIALS

Notice of Proposed Rule Making

On April 1, 1963, the Interstate Commerce Commission (ICC) published its Notice No. 58 in Docket No. 3666. The notice proposed to modify the ICC Regulations for transporting radioactive materials to bring them into accord with the recommended regulations of the International Atomic Energy Agency (IAEA). Based upon the comments received pursuant to that notice of proposed rule making and after discussion with representatives of the U.S. Atomic Energy Commission (USAEC), it became apparent that it would not be in the public interest to adopt those amendments at that time. This area of regulation was transferred to the Department of Transportation by the Department of Transportation Act (80 Stat. 931).

Since that time this Department, the ICC, and the Atomic Energy Commission have worked toward the preparation of a revision to the radioactive materials regulations. Many meetings have been held between industry and Government representatives. Several significant "enabling" regulatory amendments have been adopted which now make it practical to propose a revised major revision of these regulations. In 1966, the USAEC published its packaging standards in Part 71 of Title 10, CFR. At the same time, the ICC published Order No. 70 relating to transportation of fissile radioactive materials. Early in 1967, the ICC also published Order No. 74 which made further modifications regarding radioactive materials.

During the past 18 months a task force comprised of representatives of the USAEC and its contractors prepared a series of draft regulatory changes designed to incorporate the principles of the recommended regulations of the IAEA into the regulations as amended by Orders 70 and 74. These drafts were further modified as a result of participation by representatives of the ICC, Federal Aviation Administration, U.S. Coast Guard, and various atomic energy and transportation industry personnel. The results of all of these reviews and discussions are reflected in this notice of proposed rule making.

This notice includes proposed amendments to the Hazardous Materials Regulations of the Department of Transportation (49 CFR Parts 171-178) (formerly a part of the ICC Regulations) and Part 103 of the Federal Aviation Regulations (14 CFR Part 103). The purpose of this notice is to request public comment on procedures proposed for the transportation of radioactive materials. Interested persons are invited to participate in the making of proposed rules by submitting such written data, views, or arguments as they may desire. Communications should identify the regulatory docket and notice number and be submitted in duplicate to the Secretary, Hazardous Materials Regulations Board, Department of Transportation, 400 Sixth Street SW., Washington, D.C.

Communications received before April 15, 1968, would be considered by the Board before taking final action on the notice. All comments will be available for examination by interested persons at the Office of the Secretary of the Board, both before and after the closing date for comments. The proposals contained in this notice may be changed in light of comments received.

Several references are made in the proposed regulatory amendments to authorizations issued under Part 170 of Title 49, CFR. Part 170 has been reserved for the Rules of Procedure for the Hazardous Materials Regulations Board. Part 170 has been published as a notice of proposed rule making but has not yet been adopted. It is expected that Part 170 will be in effect before the expiration of the comment period for this notice of proposed rule making. Part 170 will include the procedures for general rule making as well as those for handling applications for special permits.

The basic consideration in the transportation of radioactive materials is that they may present radiation and contamination hazards to transportation workers, passengers, and the general public. In addition, radiation exposure may damage other materials in transport, such as undeveloped photographic film. The proposed regulatory amendments will provide for the control of these potential hazards by considering the three basic factors of (1) relative hazard potential (2) packaging performance and (3) the transportation environment. The existing regulations place the primary emphasis on the packaging requirements for the normal conditions of transportation. The proposed revisions will provide a system of allowing sufficient emphasis to be placed not only on the normal conditions of transportation, but also on the environmental conditions which a package of radioactive materials might encounter in an accident.

This notice of proposed rule making establishes a separate hazard classification category for radioactive materials, apart from the poisonous category. Radioactive materials would be classified as radioactive materials and not as Class

D poisons as they currently are. Appropriate changes are being proposed to the commodity list in Part 172.

Several provisions which are presently contained in the regulations of the U.S. Atomic Energy Commission, title 10 CFR Part 71, have been incorporated into this proposed revision. Examples are the definitions of "special form," "normal form," and "large quantities" of radioactive materials.

A major change is proposed in the method of hazard identification of radioactive materials. Assignments of hazard categories which are based solely upon the type of radiation emanating from the package is not truly representative of the transportation hazards to be considered. The proposed system is based instead upon the radiotoxicity of the isotope concerned. The hazard potential of radioactive materials is defined by consideration of radiotoxicity and physical form, and by assigning each radionuclide to an appropriate "transport group." In addition, some special classes of materials are considered, such as very large or very small quantities, low specific activity materials, and fissile materials. This system is presently prescribed in regulations of the Atomic Energy Commission, 10 CFR Part 71.

Another major area of change is in package identification. A new labeling system is proposed to conform to the recommendations of the United Nations and the IAEA. The labels will also be used to determine the need for placarding of vehicles. A later regulatory proposal will incorporate the remainder of the U.N. labels for other hazardous materials.

The proposed regulatory change will provide more types of specification packaging, increased flexibility for the shipper in terms of new package development, and a clearer definition of the criteria which the Department will be using to evaluate the adequacy of various packaging methods.

A further change would allow an increase in the amount of radioactive material that may be carried aboard a vehicle from 40 units to 50 units. This revision would also change the name for the term "radiation unit" to "transport index."

Proposed new § 173.393 contains a number of general packaging requirements, many of which are in the existing regulations. Sections 173.394 and 173.395 contain the particular packaging requirements for special form and normal form radioactive materials. These two sections could be combined into a single section but there have been indications from industry sources of the desirability of separation. Section 173.396 proposes specific packaging requirements for fissile material. This section is essentially unchanged from the present regulations except for some additional flexibility in the packaging of small amounts of fissile materials. Sections 173.396a and 173.397 incorporate the provisions included in the existing § 173.392 for "exempt quantities," and also make an additional provision for the transportation of contaminated items and bulk low specific activity materials. Section 173.398 prescribes the special test conditions for special form material and for the hypothetical accident conditions of transportation. These provisions are presently contained in Part 71 of the USAEC regulations. Section 173.399 prescribes new labeling requirements. Section 173.399a consolidates and updates the general contamination control requirements.

Appropriate changes are proposed for Parts 174, 175, and 177 to incorporate the new placarding requirements, to increase the transport index from 40 to 50, to delete certain consignee requirements that are not within the jurisdiction of these regulations, and to provide for more comprehensive distance--time handling provisions.

In Part 178 revisions are made to specifications 6L and 12B, and two new specifications are being proposed. Specification 6L is being modified to provide a wider flexibility in drum size and centering mechanisms. Tests have shown the inadequacy of the present closure requirements and the specification is being modified to require higher strength locking rings. A new specification 6M metal package is being proposed for both fissile and nonfissile radioactive materials. The special specification 12B fiberboard box for radioactive materials would be deleted since the requirements contained therein would now be included in § 173.393. A new specification 7A general package is being proposed for radioactive materials. Specification 7A provides for performance criteria rather than detailed engineering design requirements. The shipper would be given a great deal of flexibility in the exact design of his specification 7A package.

A number of editorial changes are being proposed in this Notice which do not directly bear on substantive requirements for the transportation of radioactive materials, but are being made in related provisions as a part of the general updating of the regulations. Examples are in the changes being proposed for §§ 173.22, 173.23, 173.24, and 173.28.

In Part 103 of 14 CFR appropriate amendments are being proposed to incorporate the provisions of the general revision into the Hazardous Materials Regulations applicable to aviation. At the same time, § 103.3 is being amended to reflect Amendment No. 75 regarding shipping paper requirements. Several other minor changes are being proposed to provide consistency between Parts 174-177 and Part 103.

Since the Federal Aviation Administration does not exercise jurisdiction over the handling and storage of hazardous materials in air freight terminals or other storage locations outside of aircraft, the provisions for handling, storage, and accidents are limited to aircraft only. However, the Department is considering the need for providing similar safeguards in connection with the storage and handling of radioactive materials at all times once they have entered into the realm of air transportation.

Paragraph (d) of § 103.23 would be deleted from Part 103 under this proposed amendment. This provision makes the shipper and the carrier jointly responsible for providing personnel monitoring devices. There are no similar requirements for rail, highway, and water, and the experience of the transportation industry has been that none are required in these regulations. The Atomic Energy Commission, the Department of Labor, and the Department of Health, Education, and Welfare already have established standards for exposure control of people. Removal of the requirement does not, of course, preclude the carrier or the shipper from fulfilling his responsibilities in this area.

This amendment is proposed under the authority of Title 18, United States Code, sections 831-835, section 9 of the Department of Transportation Act (49 U.S.C. 1657), and Title VI and section 902(h) of the Federal Aviation Act of 1958 (49 U.S.C. 1421-1430 and 1472(h)).

In consideration of the foregoing, it is proposed to amend Titles 14 and 49 of the Code of Federal Regulations as hereinafter set forth.

Issued in Washington, D.C., on January 11, 1968.

W. J. SMITH,
Commandant, U.S. Coast Guard.

SAM SCHNEIDER,
Board Member, for the Administrator, Federal Aviation Administration.

LOWELL K. BRIDWELL,
Administrator,
Federal Highway Administration.

A. SCHEFFER LANG,
Administrator,
Federal Railroad Administration.

I. Title 49 of the Code of Federal Regulations would be amended as follows:

1. Section 171.8 would be amended by adding the following new paragraphs at the end thereof:

§ 171.8 Definitions.

(i) "Packaging" means the assembly of the containers and any other components necessary to assure compliance with the prescribed packaging requirements.

(j) "Package" means the packaging plus its content of hazardous materials, as presented for transportation.

(k) "Transport vehicle" means the conveyance used for the transportation of hazardous materials and includes any motor vehicle, rail car, or aircraft. Each cargo-carrying body is a separate vehicle.

2. The commodity list in § 172.5(a) would be amended as follows:

§ 172.5 List of explosives and other dangerous articles.

(a) * * *

Article	Classed as—	Exemptions and packing (See sec.)	Label required if not exempt	Maximum quantity in 1 outside container by rail express
<i>Change</i>				
Fissile radioactive materials.....	Radioactive.....	173.393	Radioactive.....	See § 173.396.
Radioactive devices.....	do.....	173.396 173.393 173.396a	do.....	See § 173.396a
Radioactive materials, low specific activity (L.S.A.).....	do.....	173.393	do.....	See § 173.397(a).
Thorium nitrate, solid.....	do.....	173.397	Radioactive plus yellow.....	100 pounds.
Uranyl nitrate, solid.....	do.....	173.396 173.397	do.....	Do.
<i>Add</i>				
Radioactive materials, normal form, n.o.s.....	do.....	173.393	Radioactive.....	See §§ 173.393, 173.395.
Radioactive materials, special form, n.o.s.....	do.....	173.393 173.394	do.....	See §§ 173.393, 173.394.
<i>Cancel</i>				
Magnesium-thorium alloys in formed shapes, (not powdered, and which shall contain not more than 4 percent nominal thorium-232).....	Poison D.....	173.392(e)	Radioactive materials, red.	See § 173.393(L).
Radioactive materials, n.o.s.....	do.....	173.392 173.393	Radioactive materials, blue or red.	See § 173.393 (I) and (L).
Uranium, normal or depleted, in solid metal form (not borings, chips, or pieces).....	do.....	173.392(f)	Radioactive materials, red.	See § 173.393(L).

3. Part 173 would be amended as follows:

(A) By amending the table of contents to show § 173.23 as canceled; to show new entries for §§ 173.24 and 173.391 through 173.396; and by adding §§ 173.396a through 173.399a, as follows:

Sec.		
173.23	[Canceled]	
173.24	Standard requirements for all packages.	
173.391	Radioactive materials; definitions.	

173.392	Transport groups of radionuclides.
173.393	General packaging requirements.
173.394	Radioactive material in special form.
173.395	Radioactive material in normal form.
173.396	Fissile radioactive material.
173.396a	Small quantities of radioactive materials and radioactive devices.
173.397	Low specific activity radioactive material.
173.398	Special tests.
173.399	Radioactive materials labels.
173.399a	Contamination control.

(B) By amending § 173.2(a) to read as follows:

§ 173.2 Classification; dangerous articles.

(a) Hazardous materials other than explosives having more than one hazardous characteristic, as defined in Parts 171-190, must be classified according to the greatest hazard present. However, those articles which are also Class A poisons or radioactive materials must be classified according to both hazardous characteristics, as defined in this part.

(C) By amending § 173.22 to read as follows:

§ 173.22 Specification containers prescribed.

(a) Where containers are supplied by the shipper, the shipper shall be responsible to determine that shipments of explosives and other dangerous articles are made in containers which, unless otherwise provided in this part (see § 173.9 (c)), have been made, assembled with all parts or fittings in their proper place, and marked in compliance with applicable specifications prescribed in Parts 178 and 179 of this chapter or with specifications of the Department in effect at date of manufacture of container. The shipper may accept the manufacturer's certification or specification marking to determine that the containers were manufactured in accordance with applicable specifications. Where containers are supplied by the carrier, the shipper shall determine that the containers in which commodities are to be loaded are proper containers for the transportation of such commodities by examining the manufacturer's identification plate, specification marking, or certification by the carrier.

(b) Where the regulations require Spec. 6D or 37M (§ 178.102 or § 178.134 of this chapter) cylindrical steel overpacks, Spec. 5E, 6J, or 37A (single-trip container) (§ 178.82, § 178.100, or § 178.131 of this chapter) metal drums manufactured before March 18, 1964, having inside Spec. 2S, 2SL, 2T, or 2TL (§ 178.21, § 178.27, § 178.35, of § 178.35a of this chapter) polyethylene container, may be continued in use for the commodities and gross weights for which they were previously authorized.

(c) Reusable molded polyethylene containers for use without overpack complying with Spec. 34 (§ 178.19 of this chapter), manufactured before September 5, 1966, may be continued in use, if they are plainly marked ICC-34, and are embossed with the maker's name or symbol, rated capacity, and the month and year of manufacture.

(d) Containers manufactured before January 1, 1967, and approved by the Bureau of Explosives before July 12, 1966, (1) may be continued in use for the shipment of fissile and other radioactive materials under the approved conditions until that approval is terminated by the the Department or the Bureau of Explosives, but in no case after December 31, 1968, and (2) may not be used for export unless specifically approved by the Department.

(D) By canceling § 173.23.

§ 173.23 [Canceled]

(E) By amending § 173.24 to read as follows:

§ 173.24 Standard requirements for all packages.

(a) Each package used for shipping hazardous materials under this chapter shall be so designed and constructed, and its contents so limited that under normal and ordinary conditions incident to transportation—

(1) There will be no significant release of the dangerous materials to the environment;

(2) The effectiveness of the packaging will not be substantially reduced; and

(3) There will be no mixture of gases or vapors in the package which could, through any credible spontaneous increase of pressure or through an explosion, significantly reduce the effectiveness of the packaging.

(b) Materials for which detailed specifications for packaging are not set forth in this part must be securely packaged in strong, tight packages meeting the requirements of this section.

(c) Packaging used for the shipment of dangerous articles under this chapter shall, unless otherwise specified or exempted therein, meet all of the following design and construction criteria:

(1) Each specification container shall be marked in an unobstructed area with letters and figures identifying that specification.

(i) The marking is a certification that the packaging complies with all specification requirements.

(ii) The name and address or the symbol of the manufacturer, or the user, who assumes responsibility for compliance with the specification requirements, shall be included. Symbol letters must be registered with the Bureau of Explosives. Duplicate symbols are not authorized.

(iii) The marking shall be stamped, embossed, burned, printed, or otherwise marked on the packaging to provide adequate accessibility, permanency, and contrast so as to be readily apparent and understood.

(iv) Unless otherwise specified, letters and figures shall be at least 1/2-inch high.

(v) Packaging which does not comply with the applicable specification listed in Parts 178-179 of this chapter must not be marked to indicate such compliance.

(2) Unless otherwise specified, steel used shall be low-carbon, commercial quality steel. Open hearth, electric basic oxygen, or other similar quality steels are acceptable.

(3) Lumber used shall be well seasoned, commercially dry, and free from decay, loose knots, knots that would interfere with nailing, and other defects that would materially lessen the strength.

(4) Welding and brazing shall be performed in a workmanlike manner using suitable and appropriate techniques, materials, and equipment.

(5) Packaging materials shall be such that there will be no significant chemical or galvanic reaction among any of the materials in the package.

(6) Closures shall be adequate to prevent inadvertent leakage of the contents under normal conditions of transport. Gasketed closures shall be fitted with gaskets of efficient material which will not be deteriorated by the contents of the container. Except as specifically provided in this chapter, vented packages are not authorized.

(7) Nails, staples, and other metallic devices shall not protrude into the interior of the outer packaging in such a manner as to be likely to cause failures.

(8) The nature and thickness of the packaging shall be such that friction during transport does not generate any heating likely to decrease the chemical stability of the contents.

(d) Except as otherwise provided in this chapter, compliance with the applicable specifications in Parts 178 and 179 of this chapter shall be required in all details.

(F) By amending the introductory language of paragraph (a) and by amending paragraph (h) of § 173.28 to read as follows:

§ 173.28 Reused containers.

(a) Containers used more than once (refilled and reshipped after having been previously emptied) must be in such condition, including closure devices and cushioning materials, that they comply in all respects with the required specifications for those containers. Repairs must be made in an efficient manner in accordance with requirements for materials and construction as prescribed in Parts 178 and 179 of this chapter for new containers. Parts that are weak, broken, or otherwise deteriorated must be replaced.

(h) Except as provided in this section, single-trip containers made under specifications prescribed in Part 178 of this chapter, from which contents have once been removed following use for shipment of any commodity, shall not be again used as shipping containers for explosive or other dangerous articles. Single-trip containers may be reused if retested in accordance with methods approved by the Bureau of Explosives for service for specific commodities or classes of com-

modities. Applications for permission for reuse should be made to the Bureau of Explosives, 63 Vesey Street, New York, N.Y. 10007.

(G) By amending § 173.29(e) to read as follows:

§ 173.29 Empty containers.

(e) All containers and accessories which have been used for shipments of radioactive materials, when shipped as empty, must be securely closed, must be free of significant removable radioactive surface contamination as provided in § 173.399a, and the radiation at the external surface of the package must not exceed 0.5 millirem per hour.

(II) By amending the title of Subpart G to read as follows:

Subpart G—Poisonous Articles and Radioactive Materials; Definition and Preparation

(I) By amending the introductory language of paragraph (a) and canceling paragraph (a) (4) of § 173.325 as follows:

§ 173.325 Classes of poisonous articles.

(a) Poisonous articles for the purpose of Parts 171-179 are divided into three classes according to degree of hazard in transportation.

(4) [Canceled]

(J) By amending § 173.391 to read as follows:

§ 173.391 Radioactive materials; definitions.

For the purpose of Parts 171-179 of this chapter:

(a) "Radioactive material" means any material or combinations of materials, which spontaneously emits ionizing radiation, and of which the specific activity of a uniformly distributed mixture is greater than 0.002 microcuries per gram.

(b) "Fissile material" means radioactive material which has the additional property that it affords a possibility of a self-sustaining nuclear fission reaction, including plutonium-238, plutonium-239, plutonium-241, uranium-233, and uranium-235. Fissile material is classified according to the controls needed to provide nuclear criticality safety during transportation as follows:

(1) *Fissile Class I.* Packages which may be transported in unlimited numbers and in any arrangement, and which require no nuclear criticality safety controls during transportation.

(2) *Fissile Class II.* Packages which may be transported together in any arrangement but in numbers which do not exceed an aggregate transport index of 50. Such shipments require no nuclear criticality safety control by the shipper during transportation.

(3) *Fissile Class III.* Shipments of packages which do not meet the requirements of Fissile Classes I or II and which are controlled in transportation by special arrangements by the shipper.

Note 1: Uranium-235 exists only in combination with various percentages of uranium-234 and uranium-238. "Fissile radioactive material" as applied to uranium-235 refers to the amount of uranium-235 actually contained in the total quantity of uranium being transported.

Note 2: Radioactive material may consist of mixtures of fissile and nonfissile radionuclides. "Fissile material" refers to the amount of plutonium-238, plutonium-239, plutonium-241, uranium-233, or uranium-235 or any combination thereof actually contained in the mixture. The "radioactivity" of the mixture consists of the total activity of both the fissile and nonfissile radionuclides. All mixtures containing "fissile material" shall be subject to § 173.396.

(c) "Low specific activity material" means any of the following:

(1) Uranium or thorium ores and physical or chemical concentrates of those ores;

(2) Unirradiated natural or depleted uranium or unirradiated natural thorium;

(3) Tritium oxide in aqueous solutions provided the concentration does not exceed 5 millicuries per milliliter;

(4) Material in which the activity is uniformly distributed and in which the estimated average concentration per gram of contents does not exceed:

(i) 0.001 millicuries of Group I (see § 173.391(g)) radionuclides; or

(ii) 0.005 millicuries of Group II radionuclides; or

(iii) 0.3 millicuries of Groups III or IV radionuclides.

Note 1: This includes, but is not limited to, materials of low radioactivity concentration such as residues or solutions from chemical processing; wastes such as building rubble, metal, wood, and fabric scrap, glassware, paper and cardboard; solid or liquid plant waste; sludges and ashes.

(5) Objects of nonradioactive material externally contaminated with radioactive material, provided that the radioactive material is not readily dispersible and the surface contamination when averaged over one square meter, does not exceed 0.001 millicurie per square centimeter of Group I radionuclides or 0.001 millicurie per square centimeter of other radionuclides.

(d) "Special form" radioactive materials means those which, if released from a package, might present some direct radiation hazard but would present little hazard due to radiotoxicity and little possibility of contamination. This may be the result of inherent properties of the material (such as metals or alloys), or acquired characteristics, as through encapsulation. The criteria for determining whether a material meets the definition of special form are prescribed in § 173.398a.

(e) "Normal form" radioactive materials means those which are not special form radioactive materials. Normal form radioactive materials are grouped into Transport Groups (see § 173.391(g)).

(f) "Large quantity" radioactive materials means a quantity the aggregate radioactivity of which exceeds that specified as follows:

(1) Groups I and II (see § 173.391(g)) radionuclides: 20 curies.

(2) Groups III and IV radionuclides: 200 curies.

(3) Group V radionuclides: 5,000 curies.

(4) Group VI radionuclides: 50,000 curies.

(5) Special form material: 5,000 curies.

(g) "Transport group" means any one of six groups into which radionuclides are classified according to their relative biological hazard, and as listed in § 173.392.

(h) "Transport Index" means the number placed on a package to designate the degree of control to be exercised by the carrier during transportation. The transport index to be assigned to a package of radioactive materials shall be determined by either subparagraph (1) or (2) of this paragraph, whichever is larger. The number expressing the transport index shall be rounded up to the next highest tenth; e.g., 1.01 becomes 1.1.

(1) The highest radiation dose rate, in millirem per hour at 3 feet from any

accessible external surface of the package; or

(2) For Fissile Class II packages only, the transport index number calculated by dividing the number "50" by the number of similar packages which may be transported together (see § 173.396), as determined by the procedures prescribed in the regulations of the U.S. Atomic Energy Commission, Title 10, Code of Federal Regulations, Part 71.

(i) "Removable radioactive contamination" means radioactive contamination which can be readily removed in measurable quantities by wiping the contaminated surface with an absorbent material. The measurable quantities shall be considered as being not significant if they do not exceed the limits specified in § 173.399a.

(K) By amending § 173.392 to read as follows:

§ 173.392 Transport groups of radionuclides.

(a) List of radionuclides:

Element ¹	Radionuclide ²	Transport Group					
		I	II	III	IV	V	VI
Actinium (89)	Ac-227	X					
Americium (95)	Am-241	X					
Antimony (51)	Sb-122			X	X		
Argon (18)	Ar-41		X				X
Arsenic (33)	As-73				X	X	
Astatine (85)	At-211			X	X	X	
Barium (56)	Ba-140			X	X		
Berkelium (97)	Bk-249	X					
Beryllium (4)	Be-7				X	X	
Bismuth (83)	Bi-206			X	X		
	Bi-207		X				
	Bi-210			X	X		
Bromine (35)	Br-82			X	X		
Cadmium (48)	Cd-109			X	X		
	Cd-115m				X		
	Cd-115			X	X		
Cesium (55)	Cs-131			X	X		
	Cs-134m			X	X		
	Cs-134			X	X		
	Cs-135				X	X	
	Cs-136				X	X	
	Cs-137				X	X	
	Cs-157				X	X	
Calcium (20)	Ca-47				X	X	
Californium (98)	Cf-249	X					
	Cf-250	X					
	Cf-252	X					
Carbon (6)	C-14				X	X	
Cerium (58)	Ce-141				X	X	
	Ce-143			X	X		
	Ce-144			X	X		
Chlorine (17)	Cl-38				X	X	
Chromium (24)	Cr-51			X	X		
Cobalt (27)	Co-56			X	X		
	Co-57				X	X	
	Co-58m				X	X	
	Co-58				X	X	
	Co-60			X	X		
Copper (29)	Cu-64				X	X	
Curium (96)	Cm-243	X					
	Cm-244	X					
	Cm-245	X					
	Cm-246	X					
Dysprosium (66)	Dy-154			X	X		
	Dy-165				X	X	
	Dy-166				X	X	
Erbium (68)	Er-169				X	X	
	Er-171			X	X		
Europium (63)	Eu-150m			X	X		
	Eu-152			X	X		
	Eu-154		X				
	Eu-155				X		

See footnotes at end of table.

Element 1	Radionuclide 1	Transport Group					
		I	II	III	IV	V	VI
Fluorine (60)	F-18						
Gadolinium (64)	Gd-153				X	X	X
Gallium (31)	Ga-67		X				
Germanium (32)	Ge-71				X	X	X
Gold (79)	Au-198		X	X			
	Au-199		X	X			
	Au-201		X	X			
	Au-203		X	X			
	Au-205		X	X			
	Au-207		X	X			
	Au-209		X	X			
	Au-210		X	X			
	Au-211		X	X			
	Au-212		X	X			
	Au-213		X	X			
	Au-214		X	X			
	Au-215		X	X			
	Au-216		X	X			
	Au-217		X	X			
	Au-218		X	X			
	Au-219		X	X			
	Au-220		X	X			
	Au-221		X	X			
	Au-222		X	X			
	Au-223		X	X			
	Au-224		X	X			
	Au-225		X	X			
	Au-226		X	X			
	Au-227		X	X			
	Au-228		X	X			
	Au-229		X	X			
	Au-230		X	X			
	Au-231		X	X			
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	Au-251		X	X			
	Au-252		X	X			
	Au-253		X	X			
	Au-254		X	X			
	Au-255		X	X			
	Au-256		X	X			
	Au-257		X	X			
	Au-258		X	X			
	Au-259		X	X			
	Au-260		X	X			
	Au-261		X	X			
	Au-262		X	X			
	Au-263		X	X			
	Au-264		X	X			
	Au-265		X	X			
	Au-266		X	X			
	Au-267		X	X			
	Au-268		X	X			
	Au-269		X	X			
	Au-270		X	X			
	Au-271		X	X			
	Au-272		X	X			
	Au-273		X	X			
	Au-274		X	X			
	Au-275		X	X			
	Au-276		X	X			
	Au-277		X	X			
	Au-278		X	X			
	Au-279		X	X			
	Au-280		X	X			
	Au-281		X	X			
	Au-282		X	X			
	Au-283		X	X			
	Au-284		X	X			
	Au-285		X	X			
	Au-286		X	X			
	Au-287		X	X			
	Au-288		X	X			
	Au-289		X	X			
	Au-290		X	X			
	Au-291		X	X			
	Au-292		X	X			
	Au-293		X	X			
	Au-294		X	X			
	Au-295		X	X			
	Au-296		X	X			
	Au-297		X	X			
	Au-298		X	X			
	Au-299		X	X			
	Au-300		X	X			
	Au-301		X	X			
	Au-302		X	X			
	Au-303		X	X			
	Au-304		X	X			
	Au-305		X	X			
	Au-306		X	X			
	Au-307		X	X			
	Au-308		X	X			
	Au-309		X	X			
	Au-310		X	X			
	Au-311		X	X			
	Au-312		X	X			
	Au-313		X	X			
	Au-314		X	X			
	Au-315		X	X			
	Au-316		X	X			
	Au-317		X	X			
	Au-318		X	X			
	Au-319		X	X			
	Au-320		X	X			
	Au-321		X	X			
	Au-322		X	X			
	Au-323		X	X			
	Au-324		X	X			
	Au-325		X	X			
	Au-326		X	X			
	Au-327		X	X			
	Au-328		X	X			
	Au-329		X	X			
	Au-330		X	X			
	Au-331		X	X			
	Au-332		X	X			
	Au-333		X	X			
	Au-334		X	X			
	Au-335		X	X			
	Au-336		X	X			
	Au-337		X	X			
	Au-338		X	X			
	Au-339		X	X			
	Au-340		X	X			
	Au-341		X	X			
	Au-342		X	X			
	Au-343		X	X			
	Au-344		X	X			
	Au-345		X	X			
	Au-346		X	X			
	Au-347		X	X			
	Au-348		X	X			
	Au-349		X	X			
	Au-350		X	X			
	Au-351		X	X			
	Au-352		X	X			
	Au-353		X	X			
	Au-354		X	X			
	Au-355		X	X			
	Au-356		X	X			
	Au-357		X	X			
	Au-358		X	X			
	Au-359		X	X			
	Au-360		X	X			
	Au-361		X	X			
	Au-362		X	X			
	Au-363		X	X			
	Au-364		X	X			
	Au-365		X	X			
	Au-366		X	X			
	Au-367		X	X			
	Au-368		X	X			
	Au-369		X	X			
	Au-370		X	X			
	Au-371		X	X			
	Au-372		X	X			
	Au-373		X	X			
	Au-374		X	X			
	Au-375		X	X			
	Au-376		X	X			
	Au-377		X	X			
	Au-378		X	X			
	Au-379		X	X			
	Au-380		X	X			
	Au-381		X	X			
	Au-382		X	X			
	Au-383		X	X			
	Au-384		X	X			
	Au-385		X	X			
	Au-386		X	X			
	Au-387		X	X			
	Au-388		X	X			
	Au-389		X	X			
	Au-390		X	X			
	Au-391		X	X			
	Au-392		X	X			
	Au-393		X	X			
	Au-394		X	X			
	Au-395		X	X			
	Au-396		X	X			
	Au-397		X	X			
	Au-398		X	X			
	Au-399		X	X			
	Au-400		X	X			
	Au-401		X	X			
	Au-402		X	X			
	Au-403		X	X			
	Au-404		X	X			
	Au-405		X	X			
	Au-406		X	X			
	Au-407		X	X			
	Au-408		X	X			
	Au-409		X	X			
	Au-410		X	X			
	Au-411		X	X			
	Au-412		X	X			
	Au-413		X	X			
	Au-414		X	X			
	Au-415		X	X			
	Au-416		X	X			
	Au-417		X	X			
	Au-418		X	X			
	Au-419		X	X			
	Au-420		X</				

Element ¹	Radionuclide ²	Transport Group					
		I	II	III	IV	V	VI
Tellurium (52)	Te-125m				X		
	Te-127m				X		
	Te-127				X		
	Te-129m			X			
	Te-129			X			
Terbium (65)	Te-131m			X			
	Te-132			X			
Thallium (81)	Tl-203			X			
	Tl-204			X			
	Tl-202			X			
	Tl-204			X			
	Tl-201			X			
Thorium (90)	Tb-227		X				
	Tb-228	X					
	Tb-230	X					
	Tb-231	X					
	Tb-232			X			
	Tb-234			X			
	Tb Natural			X			
Thulium (69)	Tm-148			X			
	Tm-170			X			
	Tm-171			X			
Tin (50)	Sn-113				X		
	Sn-117			X			
	Sn-121			X			
	Sn-125			X			
Tritium (1)	H-3				X		
	H-3 (as a gas, as luminous paint, or adsorbed on solid material)				X		X
Tungsten (74)	W-181				X		
	W-185				X		
	W-187				X		
Uranium (92)	U-231	X	X				
	U-232		X				
	U-233 ⁴		X				
	U-234		X				
	U-235 ⁴		X				
	U-236		X				
	U-238		X				
	U Natural		X				
	U Enriched ⁴		X				
	U Depleted		X				
Vanadium	V-48			X			
	V-49			X			
Xenon (54)	Xe-125			X			
	Xe-131m			X			
	Xe-131m (uncompressed) ³			X		X	
	Xe-133			X			X
	Xe-133 (uncompressed) ³		X				
Ytterbium (70)	Xe-135 (uncompressed) ³				X		
	Yb-173				X		
Yttrium (39)	Y-88			X			
	Y-90			X			
	Y-91m			X			
	Y-91			X			
	Y-92			X			
	Y-93			X			
	Y-94			X			
Zinc (30)	Zn-65				X		
	Zn-69				X		
	Zn-70				X		
Zirconium (40)	Zr-93				X		
	Zr-95			X			
	Zr-96			X			
	Zr-97			X			

¹ Atomic number shown in parentheses.
² Uncompressed means at a pressure not exceeding 14.7 p.s.i. (absolute).
³ Atomic weight shown after the radionuclide symbol.
⁴ Fissile radioactive material.

(b) Any radionuclide not listed in the above table shall be assigned to one of the groups in accordance with the following table:

Radionuclide	Radioactive half-life		
	0-1,000 days	1,000 days to 10 ⁴ years	Over 10 ⁴ years
Atomic number 1-81	Group III	Group II	Group III
Atomic number 82 and over	Group I	Group I	Group III

NOTE 1: No unlisted radionuclides shall be assigned to Groups IV, V, or VI.

(c) For mixtures of radionuclides the following shall apply:

(1) If the identity and respective activity of each radionuclide are known, the permissible activity of each radionuclide shall be such that the sum of the ratio between the total activity for each

group to the permissible activity for each group will not be greater than unity.

(2) If the groups of the radionuclides are known but the amount in each group is not known, the mixture shall be assigned to the most restrictive group present.

(3) If the identity of all or some of the radionuclides is not known, each of those unidentified radionuclides shall be considered as belonging to Group I.

(4) Mixtures consisting of a single radioactive decay chain where the radionuclides are in the naturally occurring proportions shall be considered as consisting of a single radionuclide. The group and activity shall be that of the first member present in the chain; naturally occurring daughter products are excluded.

(L) By amending § 173.393 to read as follows:

§ 173.393 General packaging requirements.

(a) Unless otherwise specified, all packages and shipments of radioactive materials must meet all requirements of this section.

(b) Radioactive material must be packaged as prescribed in §§ 173.394 through 173.397.

(c) The smallest outside dimension of any package must be 4 inches or greater.

(d) Radioactive materials must be packaged in containers which have been designed to maintain shielding efficiency and leak tightness, so that, under normal conditions of transportation, there will be no release of radioactive material. If necessary, additional suitable inside packaging must be used. Each package must be capable of meeting the requirements of § 173.350-2 of this chapter (see also § 173.24). Specification containers listed as authorized for radioactive materials shipments meet those test conditions.

(e) Internal bracing or cushioning, where necessary, must be adequate to assure that the distance from the inner container to the outside wall of the package remains constant under conditions normally incident to transportation.

(f) Pyrophoric materials, in addition to the packaging prescribed in this subpart, must also meet the packaging requirements of § 173.134 or § 173.154.

(g) Liquid radioactive material must be packaged in or within a leak-resistant and corrosion-resistant inner metal container. In addition—

(1) The packaging must be adequate to prevent loss or dispersal of the radioactive contents from the inner container, if the package were subjected to the 30-foot drop test prescribed in § 173.398(b) (2) (i); or

(2) Enough absorbent material must be provided to absorb at least twice the volume of the liquid contents. The absorbent material may be located outside the radiation shield only if it can be shown that if the liquid contents were taken up by the absorbent material the resultant dose rate at the surface of the package would not exceed 1,000 millirem per hour.

(h) There must be no significant removable radioactive surface contamination on the exterior of the package (see § 173.399a).

(i) Except for shipments described in paragraph (j) of this section, all radioactive materials must be packaged in suitable containers (shielded, if necessary) so that at any time during the conditions normally incident to transportation the radiation dose rate does not exceed 200 millirem per hour at any point on the external surface of the package, and the transport index does not exceed 10.

(j) When a package is transported in a transport vehicle (except aircraft) assigned for the sole use of that consignor, the radiation dose rate from the package may exceed the limits specified in § 173.393(g) if it does not exceed at any time during transport any of the limits specified in subparagraphs (1) through

of this paragraph. Shipments must be loaded by the consignor, and unloaded by the consignee from the transport vehicle in which originally loaded.

(1) 1,000 millirem per hour at 3 feet from the external surface of the package (closed transport vehicle only);

(2) 200 millirem per hour at any point on the external surface of the car or vehicle (closed transport vehicle only);

(3) 10 millirem per hour at 6 feet from the external surface of the car or vehicle; and

(4) 2 millirem per hour in any normally occupied position in the car or vehicle.

(k) When radioactive materials are loaded by the shipper into a transport vehicle assigned for the sole use of that shipper, the shipper must observe all applicable requirements of Part 174, 175, or 177 of this chapter as appropriate.

(l) Packages consigned for export are also subject to the regulations of the foreign governments involved in the shipment. See §§ 173.8 and 173.9.

(M) By amending § 173.394 to read as follows:

§ 173.394 Radioactive material in special form.

(a) Radioactive materials in special form, in aggregate quantity not exceeding 20 curies per package, must be packaged as follows:

(1) Spec. 5B, 5D, 6A, 6B, 6C, 6J, 6K, 17C, 17H, 42B, or 42C (§§ 178.82, 178.84, 178.97, 178.98, 178.99, 178.100, 178.101, 178.107, 178.108, 178.115, 178.118 of this chapter) metal drums.

(2) Spec. 21C (§ 178.224 of this chapter) fiber drums.

(3) Spec. 15A, 15B, 15C, 15D, 19A, or 19B (§§ 178.168, 178.169, 178.170, 178.171, 178.190, 178.191 of this chapter) wooden boxes.

(4) Any Spec. 12 series (§§ 178.205 through 178.212 of this chapter) fiberboard boxes, 275-pound test minimum; or Spec. 23F or 23H (§§ 178.214 or 178.219 of this chapter) fiberboard boxes.

(5) Spec. 55 (§ 178.250 of this chapter) metal-encased shielded container. Additionally authorized for up to 300 curies per package, for domestic use only.

(6) Spec. 7A (§ 178.350 of this chapter) general package.

(7) Spec. 6M (§ 178.104 of this chapter) metal package.

(8) Any other package authorized by the Department under Part 170 of this chapter.

(b) Radioactive materials in special form, in aggregate quantity not exceeding 5,000 curies per package, must be packaged in containers as follows:

(1) Spec. 55 (§ 178.250 of this chapter) metal-encased shielded container. Packages containing more than 300 curies must meet the special tests prescribed in § 173.398(b). See also § 173.394(a)(5).

(2) Spec. 6M (§ 178.104 of this chapter) metal package.

(3) Any other package meeting the test conditions of § 173.398(b) and authorized by the Department.

(4) Any other package authorized by the Department under Part 170 of this chapter.

(c) Large quantities of radioactive materials in special form must be shipped only in packages which meet the criteria in the regulations of the U.S. Atomic Energy Commission, Title 10, Code of Federal Regulations, Part 71, and which have been specifically authorized for that use by the Department under Part 170 of this chapter. In applying for Departmental authorization of packages for large quantities of radioactive materials to be used in shipments by the U.S. Atomic Energy Commission, or one of its contractors or licensees, a copy of the license amendment or other approval issued by that Commission will be accepted in place of the package structural integrity evaluation.

(N) By amending § 173.395 to read as follows:

§ 173.395 Radioactive material in normal form.

(a) Radioactive materials in normal form not exceeding 0.001 curie of Group I radionuclides, 0.05 curie of Group II radionuclides, 3 curies of Group III radionuclides, 20 curies of Groups IV and V radionuclides, or 1,000 curies of Group VI radionuclides must be packaged as follows:

(1) Spec. 5B, 5D, 6B, 6C, 6J, 6K, 17C, 17H, 42B, or 42C (§§ 178.82, 178.84, 178.98, 178.99, 178.100, 178.101, 178.107, 178.108, 178.115, 178.118 of this chapter) metal drums.

(2) Spec. 21C (§ 178.224 of this chapter) fiber drums.

(3) Spec. 14, 15A, 15B, 15C, 15D, 19A, or 19B (§§ 178.168, 178.169, 178.170, 178.171, 178.190, 178.191 of this chapter) wooden boxes.

(4) Any Spec. 12 series (§§ 178.205 through 178.212 of this chapter) fiberboard boxes, 275-pound test minimum; or Spec. 23F or 23H (§ 178.214 or 178.219 of this chapter) fiberboard boxes.

(5) Any Spec. 3 or 4 series (§§ 178.36 through 178.44 or §§ 178.47 through 178.58 of this chapter) cylinders.

(6) Spec. 55 (§ 178.250 of this chapter) metal-encased shielded container. Authorized for up to 10 times the quantities prescribed in this paragraph, for domestic shipments only.

(7) Spec. 7A (§ 178.350 of this chapter) general package.

(8) Spec. 6M (§ 178.104 of this chapter) metal package.

(9) Any other package authorized by the Department under Part 170 of this chapter.

(b) Radioactive materials in normal form not exceeding 20 curies of Groups I or II radionuclides, 200 curies of Groups III or IV radionuclides, 5,000 curies of Group V radionuclides or 50,000 curies of Group VI radionuclides must be packaged as follows:

(1) Spec. 55 (§ 178.250 of this chapter) metal-encased shielded container meeting the special tests prescribed in § 173.398(b).

(2) Spec. 6M (§ 178.104 of this chapter) metal package.

(3) Any other package meeting the test conditions of § 173.398(b) and authorized by the Department.

(4) Any other package authorized by the Department under Part 170 of this chapter.

(c) Large quantities of radioactive materials in normal form must be shipped only in packages which meet the criteria prescribed in the regulations of the U.S. Atomic Energy Commission, Title 10, Code of Federal Regulations, Part 71, and which have been specifically authorized for such use by the Department under Part 170 of this chapter. In applying for Departmental authorization of package for large quantities of radioactive materials to be used in shipments by the U.S. Atomic Energy Commission, or one of its contractors or licensees, a copy of the license amendment or other approval issued by that Commission will be accepted in place of the package structural integrity evaluation.

(O) By amending § 173.396 to read as follows:

§ 173.396 Fissile material.

(a) The following materials are exempted from this section. They must instead be packaged in accordance with the other provisions of this subpart, as appropriate:

(1) Not more than 15 grams of fissile material;

(2) Uranium or thorium containing not more than 0.72 percent by weight of fissile material;

(3) Uranium compounds other than metal (e.g., UF₄, UF₆, or uranium oxide in bulk form, not pelleted or fabricated into shapes), and aqueous solutions of uranium, in which the total amount of uranium-233 and plutonium present does not exceed 1 percent by weight of the uranium-235 content, and the total fissile content does not exceed 1 percent by weight of the total uranium content;

(4) Homogeneous hydrogenous solutions or mixtures containing not more than:

(i) 500 grams of any fissile material, provided the atomic ratio of hydrogen to fissile material is greater than 7,600; or

(ii) 800 grams of uranium-235, if the atomic ratio of hydrogen to fissile material is greater than 5,200, and the content of other fissile material is not more than 1 percent by weight of the total uranium-235 content; or

(iii) 500 grams of uranium-233 and uranium-235, if the atomic ratio of hydrogen to fissile material is greater than 5,200, and the content of plutonium is not more than 1 percent by weight of the total uranium-233 and uranium-235 content.

(5) A package containing less than 350 grams of fissile material, if there is not more than 5 grams of fissile material in any cubic foot within the package.

(b) Fissile material in special form with radioactivity content not exceeding 20 curies, or fissile material in normal form containing not more than 0.001 curies of Group I radionuclides, 0.05 curies of Group II radionuclides, 3 curies

Group III radionuclides, or 20 curies Group IV radionuclides must be packaged as follows:

(1) Spec. 6L (§ 178.103 of this chapter) metal container.

(2) Spec. 6M (§ 178.104 of this chapter) metal package.

(3) Any container listed in § 173.395 (a). Authorized only for not more than 500 grams of uranium-235 as Fissile Class III, or not more than 40 grams of uranium-235 as Fissile Class II. For Fissile Class II shipments, the transport index to be assigned to each package shall be 0.4 for each gram of uranium-235 above 15 grams up to a maximum of 40 grams (transport index of 10).

(4) Any other package meeting the regulations of the U.S. Atomic Energy Commission, Title 10, Code of Federal Regulations, Part 71, and which has been specifically authorized for such use by the Department.

(c) Fissile material in excess of the quantities specified in paragraph (b) of this section must be shipped only in packages which meet the regulations of the U.S. Atomic Energy Commission, Title 10, Code of Federal Regulations, Part 71, and which have been specifically authorized for such use by the Department.

(d) Petitions for authorization of nonspecification containers for fissile radioactive materials and for all Fissile Class III shipments must be submitted as prescribed in Part 170 of this chapter, and must also include the following:

(1) Type and amount of fissile radioactive materials which is to be carried in each package, including:

(i) The transport index to be assigned to the package for the proposed package loadings when shipped as Fissile Class II; and

(ii) The maximum number of packages proposed when shipped as Fissile Class III.

(2) A nuclear criticality safety evaluation demonstrating that the container design and labeling, and limitation on its contents are adequate to assure nuclear criticality safety. Any tests performed in this respect should be described.

(3) In applying for Departmental authorization of packages for fissile radioactive materials to be used in shipments by the U.S. Atomic Energy Commission, or one of its contractors or licensees, a copy of the license amendment or other approval issued by that Commission will be accepted in place of the nuclear criticality safety evaluation and the package structural integrity evaluation.

(e) Mixing of packages of other types of radioactive materials, including Fissile Class I, with Fissile Class II packages is permitted if the transport index in any one transport vehicle or storage location does not exceed 50.

(f) For Fissile Class II packages shipped under the exclusive use provisions of § 173.393(j), the transport index number which is calculated for nuclear criticality control purposes must not exceed 10 for any single package or 50 for the full load, unless specifically authorized by the Department for Fissile Class III shipments.

(g) Fissile Class III shipments may be made only in accordance with subparagraph (1) or (2) of this paragraph, or in accordance with other procedures authorized by the Department. The transport controls must provide nuclear criticality safety and shall be carried out by the shipper or carrier, as appropriate, to protect against loading, transporting, or storing of that shipment together with other fissile material.

(1) Transportation in a transport vehicle assigned for the sole use of that consignor, with a specific restriction for such sole use to be provided in the special arrangements, and with instructions to that effect issued with the shipping papers; or

(2) Transportation under escort by a person in a separate vehicle, with the escort having the capability, equipment, authority, and instructions to provide administrative controls adequate to assure compliance with this paragraph.

(P) By adding the following new sections after § 173.395:

§ 173.396a Small quantities of radioactive materials and radioactive devices.

(a) Radioactive materials in normal form not exceeding 0.01 millicurie of Group I radionuclides; 0.1 millicurie of Group II radionuclides; 1 millicurie of Groups III, IV, V, or VI radionuclides, 25 curies of tritium as a gas, as luminous paint, or as absorbed on a solid material; tritium oxide in aqueous solution with a concentration not exceeding 0.5 millicuries per milliliters; 1 millicurie of radioactive material in special form; or 15 grams of uranium-235 are exempt from specification packaging, marking and labeling if the following conditions are met:

(1) The materials are packaged in strong tight packages such that there will be no leakage of radioactive materials under conditions normally incident to transportation.

(2) The package must be such that the radiation at any point on the external surface of the package does not exceed 0.5 millirem per hour.

(3) There must be no detectable radioactive surface contamination on the exterior of the package (see § 173.399a).

(4) The outside of the inner container must bear the marking "RADIO-ACTIVE."

(b) Manufactured articles such as instruments, clocks, electronic tubes or apparatus, or other similar devices, having radioactive materials (other than liquids) in a nondispersible form as a component part, are exempt from specification packaging, marking, and labeling, if the following conditions are met:

NOTE 1: For radioactive gases, the requirement for the radioactive material to be in a nondispersible form does not apply.

(1) Radioactive materials are securely contained within the items, or are securely packaged in strong, tight packages, so that there will be no leakage of radioactive materials under conditions normally incident to transportation.

(2) The radiation dose rate at 4 inches from any unpackaged item does not exceed 10 millirem per hour.

(3) The radiation dose rate at any point on the external surface of the outside container does not exceed 0.5 millirem per hour. However, for carload or truckload lots only, the radiation at the external surface of the package or the item may exceed 0.5 millirem per hour, but must not exceed 2 millirem per hour.

(4) There must be no detectable radioactive surface contamination on the exterior of the package (see § 173.399a).

(5) The outside of the package or item must bear the marking "RADIO-ACTIVE."

(6) The total radioactivity content of each package must not exceed the following:

(i) 0.001 curie of Group I radionuclides;

(ii) 0.05 curies of Group II radionuclides;

(iii) 3 curies of Groups III or IV radionuclides;

(iv) 1 curie of Groups V or VI radionuclides, except tritium;

(v) 200 curies of tritium as a gas, as luminous paint, or as absorbed on a solid material; or

(vi) 20 curies of radioactive materials in special form.

(7) The total radioactivity content of each individual article or item must not exceed 10 percent of the total package limits specified in subparagraph (6) of this paragraph.

(c) Shipments made under this section for transportation by motor carriers are exempt from Part 177, except § 177.617, of this chapter.

§ 173.397 Low specific activity materials.

(a) Low specific activity materials, with individual package contents not exceeding 0.001 curie of Group I radionuclides, 0.05 curies of Group II radionuclides, 3 curies of Group III radionuclides, 20 curies of Group IV and V radionuclides, or 1,000 curies of Group VI radionuclides, must be packaged as follows:

(1) Any specification metal drums.

(2) Any specification fiber drums.

(3) Any specification wooden boxes.

(4) Any Spec. 12 series (§§ 178.205 through 178.212 of this chapter) or Spec. 23F or 23H (§ 178.214 or § 178.219 of this chapter) fiberboard boxes.

(5) Spec. 21P (§ 178.225 of this chapter) fiber drum over-packs or Spec. 6D or 37M (§ 178.102 or § 178.134 of this chapter) cylindrical steel drum over-packs, when used with Spec. 2S, 2SL, or 2T (§ 178.21, § 178.35, or § 178.35a of this chapter) polyethylene inside containers. Authorized for low specific activity radioactive liquids. The containers are not authorized for materials containing nitric acid in strength exceeding 20 percent. The requirements of § 173.393(e) (1) and (2) do not apply to these containers.

(6) Spec. 7A (§ 178.350 of this chapter) general packaging.

(7) Any other package authorized by the Department under Part 170 of this chapter.

(b) Low specific activity materials not packaged as prescribed in paragraph (a) of this section and which are transported in transport vehicles (except aircraft) assigned for the sole use of that consignor are exempt from the packaging, marking and labeling requirements of §§ 173.393, 173.395, 173.399, and 173.401, except as specified in this section, if the shipments meet the requirements of paragraph (c) or (d) of this section.

(c) Packaged shipments of low specific activity materials transported in transport vehicles (except aircraft) assigned for the sole use of that consignor must comply with the following:

(1) Materials must be packaged in strong, tight packages so that there will be no leakage of radioactive material under conditions normally incident to transportation.

(2) Packages must not have any significant removable surface contamination.

(3) External radiation levels must comply with § 173.393(j).

(4) Shipments must be loaded by consignor and unloaded by consignee from the transport vehicle in which originally loaded.

(5) There must be no loose radioactive material in the car or vehicle.

(6) Shipment must be braced so as to prevent leakage or shift of lading under conditions normally incident to transportation.

(7) Except for shipments of uranium or thorium ores, unconcentrated, the transport vehicle must be placarded in accordance with § 174.541(b) or § 177.823 of this chapter, as appropriate.

(8) The outside of each outside package must be stenciled or otherwise marked "RADIOACTIVE—LSA."

(d) Unpackaged (bulk) shipments of low specific activity materials transported in transport vehicles (except aircraft) assigned for the sole use of that consignor must comply with the following:

(1) Authorized materials are limited to the following:

(i) Uranium or thorium ores and physical or chemical concentrates of those ores.

(ii) Uranium metal or natural thorium metal, or alloys of these materials; or

(iii) Materials of low radioactive concentration, if the average estimated radioactivity concentration does not exceed 0.001 millicurie per gram and the contribution from Group I material does not exceed 1 percent of the total radioactivity.

(iv) Objects of nonradioactive material externally contaminated with radioactive material, if the radioactive material is not readily dispersible and the surface contamination, when averaged over 1 square meter, does not exceed 0.0001 millicurie per square centimeter of Group I radionuclides or 0.001 millicurie per square centimeter of other radionuclides.

(2) Liquids must be transported in the following:

(i) Spec. 103C-W (§§ 179.200, 179.201, 179.202 of this chapter) tank cars. The requirements of § 173.393(g) do not apply to these tank cars. Bottom fittings and valves are not authorized.

(ii) Spec. MC 310, MC 311, MC 312, or MC 331 (§ 178.330, § 178.331, § 178.337, or § 178.343 of this chapter) cargo tanks. Authorized only where the radioactivity concentration does not exceed 10 percent of the specified low specific activity levels. The requirements of § 173.393(g) do not apply to these cargo tanks. Bottom fittings and valves are not authorized. Trailer-on-flat-car service is not authorized.

(iii) Any other cargo tank authorized by the Department under Part 170 of this chapter.

(3) External radiation levels must comply with subparagraphs (2), (3), and (4) of § 173.393(j).

(4) Shipments must be loaded by the consignor, and unloaded by the consignee from the transport vehicles in which originally loaded.

(5) Except for shipments of uranium or thorium ores, unconcentrated, the transport vehicle must be placarded in accordance with § 174.541(b) or § 177.823 of this chapter, as appropriate.

§ 173.393 Special tests.

(a) *Special form material.* To qualify as special form material, the radioactive material must either be in massive solid form or encapsulated. Each item, whether or not encapsulated, must have no dimension less than 0.5 millimeters, or must have at least one dimension greater than five millimeters. Each item must not dissolve or convert into dispersible form to the extent of more than 0.005 percent, by weight, by immersion for 1 week in water at 68° F. or in air at 86° F. If in solid form, the radioactive material must not break, crumble, or shatter if subjected to the percussion test prescribed hereunder, and further, must not melt, sublime, or ignite at temperatures below 1,000° F. If encapsulated, the capsule must retain its contents when subjected to all of the performance tests prescribed in this section, and must not melt, sublime, or ignite at temperatures below 1,475° F. It is not necessary to actually conduct these tests if it can be shown, through engineering evaluations or comparative data, that the material would be capable of performing satisfactorily under the prescribed test conditions.

(1) *Free drop.* A free drop through a distance of 30 feet onto a flat essentially unyielding horizontal surface, striking the surface in such a position as to suffer maximum damage.

(2) *Percussion.* Impact of the flat circular end of a 1 inch diameter steel rod weighing three pounds, dropped through a distance of 40 inches. The capsule or material shall be placed on a sheet of lead, of hardness number 3.5 or 4.5 on the Vickers scale, and not more than 1 inch thick, supported by a smooth, essentially unyielding surface.

(3) *Heating.* Heating in air to a temperature of 1,475° F. and remaining at that temperature for a period of 10 minutes.

(4) *Immersion.* Immersion for 24 hours in water at room temperature. The water shall be at pH6–pH8, with a maximum conductivity of 10 micromhos/cm.

(b) *Standards for hypothetical accident conditions of transportation.* (1) Each package used for shipping radioactive material (including fissile radioactive material) under §§ 173.394(b) and 173.395(b) must be designed and constructed and its contents so limited that, if subjected to the hypothetical accident conditions prescribed in this paragraph, it will meet the following conditions:

(i) The reduction of shielding would not be enough to increase the radiation dose rate at 3 feet from the external surface of the package to more than 1,000 millirem per hour.

(ii) No radioactive material would be released from the package.

(2) Test conditions: The conditions which the package must be capable of withstanding must be applied sequentially, to determine their cumulative effect on a package, in the following order:

(i) *Free drop.* A free drop through a distance of 30 feet onto a flat essentially unyielding horizontal target surface, striking the surface in a position for which maximum damage is expected. The target surface must be such that the total impact energy shall be absorbed by the packaging.

(ii) *Puncture.* A free drop through a distance of 40 inches striking, in a position for which maximum damage is expected, the top end of a vertical cylindrical mild steel bar mounted on an essentially unyielding horizontal surface. The bar shall be 6 inches in diameter, with the top horizontal and its edge rounded to a radius of not more than one-quarter inch, and of such a length as to cause maximum damage to the package, but not less than 8 inches long. The long axis of the bar shall be perpendicular to the package surface.

(iii) *Thermal.* Exposure for 30 minutes within a source of radiant heat having a temperature of 1,475° F. and an emissivity coefficient of 0.9, or equivalent. For calculational purposes, it shall be assumed that the package has an absorption coefficient of 0.8. The package shall not be cooled artificially until after the 30-minute test period has expired and the temperature at the center of the package has begun to fall.

(iv) *Water immersion (fissile radioactive materials packages only).* Immersion in water for 24 hours to a depth of at least 3 feet.

§ 173.399 Radioactive materials labels.

(a) Each package of radioactive materials, unless exempted by § 173.396a or § 173.397, shall be labeled as provided in this section (see § 173.414 for description of labels). The label to be used shall be determined by the transport index or other considerations as follows:

1) Radioactive white label:

(i) Each package not exceeding 0.5 millirem per hour at any point on the external surface of the package, and having a transport index of zero. (Not authorized for Fissile Class II or III packages.)

(2) Radioactive yellow label: When the limit in subparagraph (1) of this paragraph is exceeded, and—

(i) Each package not exceeding 10 millirem per hour at any point on the external surface of the package and not exceeding 0.5 millirem per hour at three feet from the external surface of the package; and

(ii) Each package for which the transport index does not exceed 0.5 at any time during transportation. (Not authorized for Fissile Class III packages.)

(3) Radioactive yellow III label: When the limit in subparagraph (2) of this paragraph is exceeded, and—

(i) Each Fissile Class III package;

(ii) Each package containing a large quantity of radioactive material as defined in § 173.391; and

(iii) Each package being transported under a permit issued by the Bureau of Explosives, as authorized in § 173.22(d).

(b) Radioactive materials having other hazardous characteristics, as defined elsewhere in this part, must also be labeled with other labels as required by this part according to the hazards of the commodity (see §§ 173.2 and 173.402). For example:

(1) Packages containing the solid nitrates of uranium or thorium must bear both a "radioactive" label, and a "yellow" oxidizing materials label.

(c) Detonating fuses with radioactive components as described in § 173.53(g) (2) are exempt from the labeling requirements of this section.

§ 173.399a Contamination control.

(a) Removable radioactive contamination is not significant if the average amount of radioactive contamination which can be removed by wiping the external surface of the package with an absorbent material, as measured on the wiping material, does not exceed—

(1) 10^{-11} curie per square centimeter beta-gamma (2,200 disintegrations/min. per 100 square centimeters) and 10^{-12} curie per square centimeter alpha (220 disintegrations/min. per 100 square centimeters) for all contaminants except natural or depleted uranium and natural thorium; or

(2) 10^{-10} curie per square centimeter beta-gamma (22,000 disintegrations/min. per 100 square centimeters) and 10^{-11} curie per square centimeter alpha (2,200 disintegrations/min. per 100 square centimeters) where the only contaminant is known to be natural or depleted uranium or natural thorium.

(b) Each transport vehicle used for transporting low specific activity radioactive materials in carload or truckload lots under § 173.397(d) must be surveyed by the carrier, or other person designated by the carrier, with radiation detection instruments after each use. Where the survey shows that the surface

radiation dose rate exceeds 0.5 millirem per hour, or that there is significant removable radioactive surface contamination, the carrier is responsible for cleaning the transport vehicle so that the radiation dose rates are reduced to below those levels.

(c) This section does not apply to any transport vehicle (except aircraft) used solely for the transportation of radioactive materials, if a survey of its interior surface shows that the radiation dose rate does not exceed 10 millirem per hour at the interior surface or 2 millirem per hour at 3 feet from any interior surface. These vehicles must be stenciled with the words "FOR RADIOACTIVE MATERIALS USE ONLY" in lettering at least three inches high in a conspicuous place or places, on both sides of the exterior of the vehicle.

(Q) In § 173.402, by cancelling paragraphs (a) (9) and (10) and (d); by adding a new paragraph (c) (2); and by amending paragraphs (a) (8), (b) (1), (c), and (c) (1), as follows:

§ 173.402 Labeling dangerous articles.

(a) * * *

(8) "Radioactive" as described in § 173.414 on packages of radiative material as prescribed in § 173.399, unless exempted by § 173.396a or § 173.397.

(b) * * *

(1) Labels authorized for shipments of explosives and other dangerous articles by air are shown in §§ 173.405(b), 173.406(b), 173.407(b), 173.408(b), 173.409(b), 173.410(b), 173.411(b), 173.412(b), and 173.414.

(c) Labels are not required on carload or truckload lots of dangerous articles, except for the commodities listed in this paragraph, when the shipments are loaded by the shipper, and are unloaded by the consignee from the transport vehicle in which originally loaded. The commodities for which this exemption does not apply include: Explosives, Class A; Poisons, Class A; etiological agents; and radioactive materials.

(1) Labels are not required on carload or truckload lots of any dangerous articles for shipments made by, for, or to the Department of Defense if the shipments are loaded by the shipper and unloaded by the consignee from the transport vehicle in which originally loaded and if the shipments are accompanied by qualified personnel supplied with equipment to repair leaks or other container failures which would permit escape of contents.

(2) The proper shipping name of the contents must be marked on each package shipped under the exemption in this paragraph.

(R) By amending § 173.414 to read as follows:

§ 173.414 Radioactive materials labels.

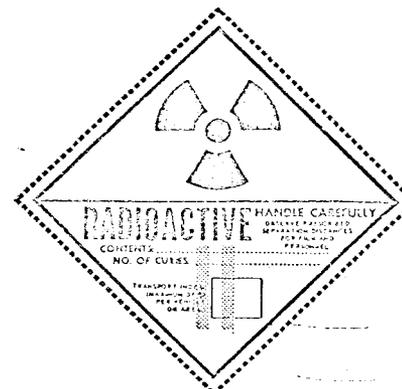
(a) Labels for packages of radioactive materials must be of diamond shape, in colors specified in this section, with each side at least 4 inches long. Printing must be in black inside of a black line border

measuring at least 3½ inches on each side and as shown in this section.

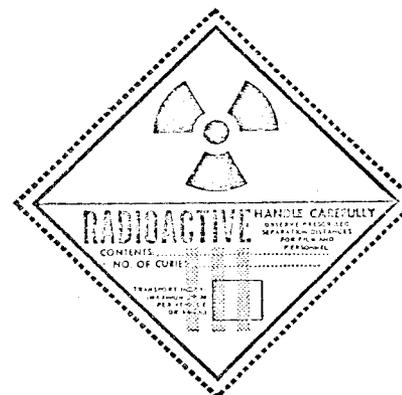
(b) "Radioactive white" label for radioactive materials. Label must be white in color. A single red vertical bar must be overprinted on the lower half of the label.



(c) "Radioactive yellow" label for radioactive materials. The upper half of the label must be bright yellow and the bottom half must be white. Two red vertical bars must be overprinted on the lower half of the label.



(d) "Radioactive yellow III" label for radioactive materials. The upper half of the label must be bright yellow and the bottom half must be white. Three red vertical bars must be overprinted on the lower half of the label.



4. Part 174 would be amended as follows:

(A) By amending paragraphs (j) (1) and (2) of § 174.532 to read as follows:

§ 174.532 Loading other dangerous articles.

(j) Radioactive materials.

(1) Shipments of low specific activity materials, as defined in § 173.391(c) of this chapter, must be loaded so as to avoid spillage and scattering of loose material. Loading restrictions are prescribed in § 173.397 of this chapter.

(2) Storage and loading restrictions are prescribed in § 174.585(h).

(B) By amending § 174.541(b) to read as follows:

§ 174.541 "Dangerous" placards; "Dangerous-Radioactive material" placards; or "Caution-Residual phosphorus" placards.

(b) "Dangerous-Radioactive Material" placards, as prescribed in § 174.553, must be applied to cars containing packages bearing a "radioactive yellow-III" label (three vertical red stripes) as prescribed in § 173.414(d) of this chapter, and to carload lots loaded under §§ 173.393 (j), (k), and 173.397 of this chapter.

(C) By amending § 174.544(a) (6) to read as follows:

§ 174.544 Placards not required.

(a) * * *

(6) Cars containing packages of radioactive material which are exempted from labeling under § 173.396a of this chapter, or which bear only the labels

prescribed in § 173.414 (b) and (c) of this chapter.

(D) By amending paragraphs (d) and (d) (1) of § 174.566 to read as follows by adding new paragraphs (d) (2) and (e) to § 174.566, as follows:

§ 174.566 Cleaning cars.

(d) Cars contaminated with radioactive materials:

(1) Each car used for transporting low specific activity radioactive materials in carload or truckload lots under the provisions of § 173.397(d) must be surveyed by the carrier, or other person designated by the carrier, with radiation detection instruments after each use. If the survey shows that the surface radiation dose rate exceeds 0.5 millirem per hour, or that there is significant removable radioactive surface contamination, the carrier is responsible for cleaning the car so that the radiation dose rates are reduced to below those levels.

(2) This section does not apply to any car used solely for transporting radioactive materials if a survey of the interior surface shows that the radiation dose rate does not exceed 10 millirem per hour at the interior surface or 2 millirem per hour at 3 feet from any interior surface. These cars must be stenciled with the words "FOR RADIOACTIVE MATERIALS USE ONLY" in lettering at least 3 inches high in a conspicuous place on both sides of the exterior of the car.

(e) In case of fire, wreck, breakage, or unusual delay involving shipments of radioactive material, see § 174.588.

(E) By amending the table in paragraph (a) of § 174.584 as follows and cancelling footnote 1 of the table:

§ 174.584 Waybills, switching orders, or other billing.

(a) * * *

closer than 3 feet to an area (or dividing partition between areas) which may be continuously occupied by passengers, employees, or shipments of animals, nor closer than 15 feet to any package containing undeveloped film (if so marked). If more than one of these packages is present, the distance must be computed from the table below on the basis of the total transport index number (determined by adding together the transport index numbers on the labels of the individual packages) of packages in the car or storeroom:

Total transport index	Minimum separation distance in feet to nearest undeveloped film	Distance in feet to area of passengers or employees, or distance in feet from dividing partition of a combination car
None.....	0	0
0.1-10.0.....	15	3
10.1-20.0.....	22	4
20.1-30.0.....	29	5
30.1-40.0.....	33	6
40.1-50.0.....	36	7

NOTE 1: The distance in the table must be measured from the nearest point on the packages of radioactive materials.

(G) By amending § 174.588(c) (1) to read as follows:

§ 174.588 Disposition of damaged or stray shipments.

(c) * * *

(1) Radioactive materials. In case of fire, wreck, breakage, or unusual delay involving shipments of radioactive materials, the carrier shall immediately notify the shipper and the Department. Cars, buildings, areas, or equipment in which radioactive materials have been spilled may not be again placed in service or routinely occupied until decontaminated by qualified persons, so that at any accessible surface the radiation dose rate is less than 0.5 millirem per hour and there is no significant removable radioactive surface contamination.

NOTE 1: In these instances, the package or materials should be segregated as far as practicable from personnel contact. If radiological advice or assistance is needed, the U.S. Atomic Energy Commission should also be notified. In case of obvious leakage, or if it appears likely that the inside container may have been damaged, care should be taken to avoid inhalation, ingestion, or contact with the radioactive material. Any loose radioactive materials should be left in a segregated area and held pending disposal instructions from qualified persons.

NOTE 2: Details involving the handling of radioactive materials in the event of a crash can be found in Bureau of Explosives Pamphlet No. 22, "Recommended Practices for Handling Collisions and Derailments Involving Explosives, Gasoline and Other Dangerous Articles," available from the Bureau of Explosives, Association of American Railroads, 63 Vesey Street, New York, N.Y. 10007.

5. In Part 175, § 175.655(j) would be amended to read as follows:

§ 175.655 Protection of packages.

(j) Radioactive materials:

(1) The number of packages of radioactive materials, as provided in

	Label notation to follow entry of the article on the billing	Placard notation to follow entry of the article on the billing	Placard endorsement must be 3/4" high and appear on the billing near the space provided for the car number
<i>Add</i>			
For radioactive materials with "radioactive white" or "radioactive yellow" labels.	Radioactive white or radioactive yellow label.	None.....	None.
For radioactive materials with "radioactive yellow-III" label.	Radioactive yellow-III.	Dangerous radioactive material placard.	"Radioactive Material."
<i>Cancel</i>			
For radioactive materials, class D poison.	Radioactive material label.	do.....	Do.

¹ Canceled.

(F) By amending § 174.586(h) to read as follows:

§ 174.586 Handling explosives and other dangerous articles.

(h) Radioactive materials:

(1) The number of packages of radioactive materials, as provided in §§ 173.393 through 173.396 of this chapter, in any rail car or storage location, must be limited so that the total transport index

number, as defined in § 173.391(g) of this chapter and determined by adding together the transport index numbers on the labels of the individual packages, does not exceed 50. This provision does not apply to sole-use shipments described in § 173.393 (j) or (k) or § 173.397 of this chapter.

(2) Packages of radioactive material bearing "radioactive yellow" or "radioactive yellow-III" labels must not be placed in cars, depots, or other places

§§ 173.393 through 173.396 of this chapter, in any rail car or storage location, must be limited so that the total transport index number, as defined in § 173.391(h) of this chapter and determined by adding together the transport index numbers shown on the labels of the individual packages, does not exceed 50. This provision does not apply to sole-use shipments described in § 173.393 (j) or (k) or § 173.397 of this chapter.

(2) Packages of radioactive material bearing "radioactive yellow" or "radioactive yellow-III" labels shall not be placed in cars, depots, or other places closer than 3 feet to an area (or dividing partition between areas) which may be continuously occupied by passengers, employees, or shipments of animals, nor closer than 15 feet to any package containing undeveloped film (if so marked). If more than one of these packages is present, the distance shall be computed from the following table on the basis of the total transport index number (determined by adding together the transport index numbers on the labels of the individual packages) of packages in the car or storeroom.

Total transport index	Minimum separation distance in feet to nearest undeveloped film	Distance in feet to area of passengers or employees, or distance in feet from dividing partition of a combination car
None.....	0	0
0.1-1.0.....	15	3
1.1-5.0.....	22	4
5.1-10.0.....	29	5
10.1-20.0.....	33	6
20.1-30.0.....	36	7

NOTE 1: The distance in the table must be measured from the nearest point of the packages of radioactive materials.

(3) In case of fire, wreck, breakage, or unusual delay involving shipments of radioactive materials, the carrier shall immediately notify the shipper and the Department. Cars, buildings, areas, or equipment in which radioactive materials have been spilled may not be again placed in service or routinely occupied until decontaminated by qualified persons, so that at any accessible surface the radiation dose rate is less than 0.5 millirem per hour and there is no significant removable radioactive surface contamination.

NOTE 1: In these instances, the package or materials should be segregated as far as practicable from personnel contact. If radiological advice or assistance is needed, the U.S. Atomic Energy Commission should also be notified. In case of obvious leakage, or if it appears likely that the inside container may have been damaged, care should be taken to avoid inhalation, ingestion, or contact with the radioactive material. Any loose radioactive materials should be left in a segregated area and held pending disposal instructions from qualified persons.

NOTE 2: Details involving the handling of radioactive materials in the event of a wreck can be found in Bureau of Explosives Pamphlet No. 22, "Recommended Practices for

Handling Collisions and Derailments Involving Explosives, Gasoline and Other Dangerous Articles," available from the Bureau of Explosives, Association of American Railroads, 63 Vesey Street, New York, N.Y. 10007.

6. Part 177 would be amended as follows:

(A) By adding the following new items to the table of contents:

Sec.	
177.842	Radioactive materials.
177.843	Contamination of vehicles.
177.861	Accidents; radioactive materials.

(B) By amending the ninth listing in § 177.823 to read as follows:

§ 177.823 Required exterior marking on motor vehicles and combinations.

- (a)
- (1)

Commodity	Type of Marking or placard
Change: Radioactive material, any quantity requiring "radioactive yellow-III" label (see § 173.414(d)).	RADIOACTIVE (Black letters on yellow background).

(C) By canceling § 177.841(d) as follows:

§ 177.841 Poisons.

(d) [Canceled]

(D) By adding the following new §§ 177.842 and 177.843:

§ 177.842 Radioactive material.

(a) The number of packages of radioactive materials, as provided for in §§ 173.393 through 173.396 of this chapter, in any motor vehicle, trailer or storage location must be limited so that the total transport index number, as defined in § 173.391(h) of this chapter, and determined by adding together the transport index numbers shown on the labels of the individual packages does not exceed 50. This provision does not apply to sole-use shipments described in § 173.393 (j) or (k) or § 173.397 of this chapter.

(b) Packages of radioactive material bearing "radioactive yellow" or "radioactive yellow-III" labels shall not be placed in motor vehicles or other places closer than the distances shown in the following table to any area which may be continuously occupied by passengers, employees, or shipments of animals, not closer than the distances shown in the table below to any package containing undeveloped film (if so marked). If more than one of these packages is present, the distance shall be computed from the following table on the basis of the total transport index number (determined by adding together the transport index numbers on the labels of the individual packages) of packages in the vehicle or storeroom.

Total transport index	Minimum separation distances in feet to nearest undeveloped film for various times of transit					Distance in feet to area of passengers or employees, or distance in feet from dividing partition of cargo compartments.
	up to 2 hours	2-4 hours	4-8 hours	8-12 hours	over 12 hours	
None.....	0	0	0	0	0	0
0.1-1.0.....	1	2	3	4	5	1
1.1-5.0.....	3	4	6	8	11	2
5.1-10.0.....	4	6	9	11	15	3
10.1-20.0.....	5	8	12	16	22	4
20.1-30.0.....	7	10	15	20	29	5
30.1-40.0.....	8	11	17	22	33	6
40.1-50.0.....	9	12	19	24	36	7

NOTE 1: The distance in the table must be measured from the nearest point of the package of radioactive materials.

(c) Shipments of low specific activity materials, as defined in § 173.391 of this chapter, must be loaded so as to avoid spillage and scattering of loose materials. Loading restrictions are set forth in § 173.397 of this chapter.

(d) Packages must be so blocked and braced that they cannot change position during conditions normally incident to transportation.

(e) Persons should not remain unnecessarily in a vehicle containing radioactive materials.

§ 177.813 Contamination of vehicles.

(a) Each motor vehicle used for transporting low specific activity radioactive materials in carload or truckload lots under the provisions of § 173.397(d) must be surveyed by the carrier, or other person designated by the carrier, with radiation detection instruments after each use. If the survey shows that the surface radiation dose rate exceeds 0.5 millirem per hour, or that there is significant removable radioactive surface contamination, the carrier is responsible for cleaning the motor vehicle so that the radiation dose rates are reduced to below those levels.

(b) This section does not apply to any vehicle used solely for transporting radioactive material if a survey of the interior surface shows that the radiation dose rate does not exceed 10 millirem per hour at the interior surface or 2 millirem per hour at 3 feet from any interior surface. Such vehicles must be stenciled with the words "FOR RADIOACTIVE MATERIALS USE ONLY" in lettering at least 3 inches high in a conspicuous place, on both sides of the exterior of the vehicle.

(c) In case of fire, wreck, breakage, or unusual delay involving shipments of radioactive material, see § 177.861.

(E) By canceling paragraphs (c) and (d) of § 177.860:

§ 177.860 Accidents; poisons.

- (c) [Canceled]
- (d) [Canceled]

(F) By adding the following new § 177.861:

§ 177.861 Accidents; radioactive materials.

(a) *Radioactive materials.* In case of fire, wreck, breakage, or unusual delay involving shipments of radioactive materials, the carrier shall immediately notify the shipper and the Department. Vehicles, buildings, areas, or equipment in which radioactive materials have been spilled may not be again placed in service or routinely occupied until decontaminated by qualified persons, so that at any accessible surface the radiation dose rate is less than 0.5 millirem per hour and there is no significant removable radioactive surface contamination.

NOTE 1: In these instances, the package or materials should be segregated as far as practicable from personnel contact. If radiological advice or assistance is needed, the U.S. Atomic Energy Commission should also be notified. In case of obvious leakage, or if it appears likely that the inside container may have been damaged, care should be taken to avoid inhalation, ingestion, or contact with the radioactive material. Any loose radioactive materials should be left in a segregated area and held pending disposal instructions from qualified persons.

NOTE 2: Details involving the handling of radioactive materials in the event of a wreck can be found in Bureau of Explosives Pamphlet No. 22, "Recommended Practices for Handling Collisions and Derailments Involving Explosives, Gasoline and Other Dangerous Articles," available from the Bureau of Explosives, Association of American Railroads, 63 Vesey Street, New York, N.Y. 10007.

(b) *Cleaning vehicles.* See § 177.843.

(G) By amending § 177.870(g) to read as follows:

§ 177.870 Regulations for passenger-carrying vehicles.

(g) *Radioactive materials.* Except by special authorization by the Department, carriers must not transport any radioactive material bearing either "radioactive yellow" or "radioactive yellow-III" labels in or on any bus or other motor vehicle while engaged in transporting passengers.

7. Part 178 would be amended as follows:

(A) By adding the following new items to the table of contents:

Sec. 178.104 Specification 6M; package for radioactive materials.

Subpart K—Specifications for General Packages
Sec. 178.350 Specification 7A; general package.

(B) By amending § 178.103-2(a) to read as follows:

§ 178.103-2 Rated capacity.

(a) Authorized only for not more than 14 kilograms of uranium-235 as metal or oxide, or as compounds or alloys which will not decompose at temperatures up to 750° F. Each container shipped as Fissile Class II shall be assigned a transport index of one (1) (unless external radiation levels require a higher assignment). The atomic ratio of hydrogen to uranium-235 shall not

exceed three, all sources of hydrogen within the inside container being considered.

(C) By amending § 178.103-3 (a), (b), and (c) to read as follows:

§ 178.103-3 General requirements.

(a) Outside container must conform to Spec. 6J (§ 178.100) or 17II (§ 178.118) 55-gallon capacity steel drum, or equivalent, except as otherwise specified herein. The drum wall must be at least 18-gauge steel, and may be either a single sheet of steel with three or more rolling hoops, or may be produced by welding together two appropriate lengths of such drums. The removable head must be constructed of at least 16-gauge steel with one or more corrugations in the cover near the periphery.

(b) Inner container must conform to Spec. 2R (§ 178.34), or equivalent (except that cast iron is not authorized), with maximum usable inside diameter of 5 1/4 inches, maximum outside length of 50 inches (with cap in place) and minimum wall thickness of one-fourth inch. Material shall be Schedule 40 steel pipe or other material having equivalent physical strength and fire resistance. Flanged closures are not authorized. Pipe threads must be luted with an appropriate nonhardening compound to prevent leakage of water or loosening of the cap due to vibration.

(c) Inner container must be fixed within the outer container with appropriate centering devices of adequate physical strength and fire resistance to be able to withstand the accident test conditions of § 173.398 of this chapter without a displacement of the inner container of more than 2 inches in any direction. The following types of centering mechanisms meet this requirement without need for performing the accident tests. Any other type of centering device must be specifically authorized by the Department.

(1) Not less than four steel rod spacers, of at least one-fourth inch (for packages of 55-gallon capacity) or three-eighths inch (for packages with greater than 55-gallon capacity) cold rolled steel, welded to the pipe at each end by minimum 2-inch continuous weld. Rods must be welded to the pipe at radial positions not exceeding 90°, and so as not to interfere with closure of inner container. Each spacer rod must extend 3 inches beyond the inner container at each end, then radially to the wall of the outer container (to provide a spring-like snug fit) and along the entire length of the wall of the outer container. For packages of more than 55-gallon capacity, each spacer rod shall be braced by welding a 1/4-inch by 2-inch steel plate strip to the spacer rod and the pipe with a continuous weld at each joint, the joints being located approximately halfway along the length of the container.

(2) At least three steel "spiders," not more than 24 inches apart, with each having at least four legs. Each leg must be constructed of at least 1/4-inch by

1-inch steel angle iron, welded by continuous weld at each joint to inner and outer steel bands of at least 1/4-inch by 1-inch steel. The inner steel band must be welded to the inner container by at least six 2-inch welds on both edges of the band.

(D) By amending § 178.103-5 to read as follows:

§ 178.103-5 Closure.

(a) The outer container closure shall be at least a 12-gauge bolted ring with drop-forged lugs, one of which is threaded, and having at least a 3/8-inch steel bolt and a lock nut, or equivalent device.

(b) The closure device must have affixed to it a tamper-proof lock wire and seal adequate to prevent inadvertent opening of the package, and of a type that must be broken if the package is opened.

(E) By adding the following new § 178.104:

§ 178.104 Specification 6M; metal package for radioactive materials.

§ 178.104-1 General requirements.

(a) Each package must meet the applicable requirements of § 173.24 of this chapter.

§ 178.104-2 Rated capacity.

(a) Authorized only for radioactive materials which will not decompose at temperatures up to 250° F., as prescribed below.

(1) *Fissile radioactive materials as shown in the following table.* The atomic ratio of hydrogen to fissile material shall not exceed three, all sources of hydrogen within the inside container being considered. Packages are authorized as Fissile Class II, with the transport index to be assigned as shown in the table. Shipments are authorized as Fissile Class III, with not more than the listed number of packages per transport vehicle.

	Maximum package— age— number contents (kilograms)	Transport index (fissile class II)	Maximum number of pack- ages per transport vehicle (fissile class III)
1. Plutonium or uranium-233:			
a. Oxide.....	6.0	0.7	195
b. Metal, alloys or other compounds.	14.5 3.0 2.5 1.0	3.6 3.6 2.8 .7	35 35 45 202
2. Uranium-235:			
a. Oxide.....	6.0	.1	3,415
b. Metal, alloy or other com- pounds.	11.0 7.0 3.5	3.0 1.3 .4	42 97 358

¹ Divided into two parts of not more than 2.25 kilograms each, and each part separate 1 by at least 2 1/4 inches by an appropriate divider mechanism.

(2) *Other solid radioactive materials.* Thermal decay energy output shall not exceed 3 watts. Radiation levels shall not exceed those prescribed in § 173.393 of this chapter.

§ 178.101-3 Package construction.

(a) Outside container must conform to Spec. 6C, 6J, 17C, or 17H (§§ 178.99, 178.100, 178.115, 178.118) steel drum, or equivalent, except as otherwise specified herein. Inside dimensions must be at least 13 $\frac{3}{4}$ inches in diameter and 15 $\frac{3}{4}$ inches in height.

(b) Inner container must conform to Spec. 2R (§ 178.34) or equivalent (except that cast iron is not authorized), with maximum usable inside diameter of 5 $\frac{1}{4}$ inches and minimum wall thickness of one-eighth inch. Material shall be Schedule 40 steel pipe or other material having equivalent physical strength and fire resistance. Pipe threads must be luted with an appropriate nonhardening compound to prevent leakage of water or loosening of the cap due to vibration or heat.

(c) Inner container must be fixed within the outer container with appropriate centering devices of adequate physical strength and fire resistance to be able to withstand the accident test conditions prescribed in § 173.398 of this chapter without a displacement of the inner container of more than 2 inches in any direction. The following types of centering mechanisms meet this requirement. Any other type of centering device must be specifically approved by the Department.

(1) Machined discs and rings of wood, plywood, or nonflammable solid fiberboard multipurpose insulating material or other nonflammable material having an equivalent thermal and shock absorbing effect. The sides of the inner container shall be protected by at least 3 $\frac{3}{4}$ inches of such material, and the ends by 1 $\frac{3}{8}$ inches of such material. There must be no gap or direct heat path to the inner container.

(d) Any radiation shielding material used must be placed within the inner container, and must be protected in all directions by at least 4 inches of the thermal insulating material described in this section. Each such shielded package must be able to withstand the fire test conditions prescribed in § 173.398 of this chapter.

(e) Gross weight shall conform to the limits prescribed in § 178.99-5.

§ 178.101-4 Closure.

(a) The outer container closure must be at least a 12-gauge bolted ring with drop-forged lugs, one of which is threaded, and having at least a $\frac{5}{16}$ -inch steel bolt for drum sizes not over 30 gallons or a $\frac{3}{8}$ -inch steel bolt for drum sizes over 30 gallons, and having a lock nut or equivalent device.

(b) The closure device must have affixed to it a tamper-proof lock wire and seal adequate to prevent inadvertent opening of the package, and of a type that must be broken if the package is opened.

§ 178.103-5 Markings.

(a) Marking on the outside of each inner container as follows: "DOT-2R" and "RADIOACTIVE MATERIALS."

(b) Marking on the outside of each package as follows: "DOT-6M"; "RADIOACTIVE MATERIALS" or "FISSILE RADIOACTIVE MATERIALS", as appropriate; and the gauge of metal in the thinnest part, rated capacity in gallons, and year of manufacture (for example, 18-30-67).

(c) Marking to conform with § 173.24 of this chapter.

(F) By canceling § 178.205-38:

§ 178.205-38 [Canceled]

Subpart K—Specifications for General Packages

§ 178.350 Specification 7A; general package.

§ 178.350-1 General requirements.

(a) Each package must meet all applicable requirements of § 173.24 of this chapter.

§ 178.350-2 Specific requirements.

(a) Each package must be so designed and constructed that, under the environmental and test conditions prescribed in this section:

(1) There will no release of radioactive material from the package;

(2) The effectiveness of the packaging will not be substantially reduced; and

(3) There will be no mixture of gases or vapors in the package which could, through any credible increase of pressure or an explosion, significantly reduce the effectiveness of the package.

(b) Environmental conditions:

(1) *Heat.* Direct sunlight at an ambient temperature of 130° F. in still air.

(2) *Cold.* An ambient temperature of -40° F. in still air and shade.

(3) *Reduced pressure.* Ambient atmospheric pressure of 0.5 atmosphere (absolute) (7.3 p.s.i.a.).

(4) *Vibration.* Vibration normally incident to transportation.

(c) Test conditions:

(1) *Water spray.* A water spray heavy enough to keep the entire exposed surface of the package except the bottom continuously wet during a period of 30 minutes.

(2) *Free drop.* Within 1 $\frac{1}{2}$ to 2 $\frac{1}{2}$ hours after the conclusion of the water spray test, a free drop through a distance of 4 feet onto a flat essentially unyielding horizontal surface, striking the surface in a position for which maximum damage is expected.

(3) *Corner drop.* A free drop onto each corner of the package in succession, or in the case of a cylindrical package onto each quarter of each rim, from a height of one foot. This test applies only to packages which are constructed primarily of wood or fiberboard, and do not exceed 110 pounds gross weight.

(4) *Penetration.* Impact of the hemispherical end of a vertical steel cylinder 1 $\frac{1}{4}$ inches in diameter and weighing 13 pounds, dropped from a height of 40 inches onto the exposed surface of the package which is expected to be most vulnerable to puncture. The long axis of the cylinder shall be perpendicular to the package surface.

(5) *Compression.* For packages not more than 10,000 pounds in weight, a

compressive load equal to either five times the weight of the package or 2 pounds per square inch multiplied by the maximum horizontal cross section of the package, whichever is greater. The load shall be applied during a period of 24 hours, uniformly against the top and bottom of the package in the position in which the package would normally be transported.

§ 178.350-3 Marking.

(a) Marking on the outside of each package as follows: "DOT-7A" and "RADIOACTIVE MATERIAL".

II. Title 14 of the Code of Federal Regulations would be amended as follows:

1. Part 103 would be amended as follows:

(A) By amending § 103.1 (b) and (c) (3) to read as follows and by cancelling paragraph (c) (4):

§ 103.1 Applicability.

(b) For the purposes of this part, "dangerous articles" are those articles defined and regulated in the applicable regulations of the Department of Transportation (49 CFR Parts 171-190).

(c) * * *

(3) Shipments of radioactive materials via cargo aircraft, made by or under the direction or supervision of the U.S. Atomic Energy Commission or the Department of Defense, which are escorted by personnel especially designated by or under the authority of that Commission or Department for the purposes of national security.

(4) [Canceled]

(B) By amending § 103.3 (a) and (b) to read as follows:

§ 103.3 Certification requirements.

(a) No shipper may offer, and no person operating an aircraft may knowingly accept, any dangerous article for shipment in an aircraft unless there is accompanying the shipment a clear and visible statement which reads as follows: "This is to certify that the above-named articles are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation. In the applicable case of shipments in passenger-carrying aircraft, the shipper shall also add the words: "This shipment is within the limitations prescribed for passenger-carrying aircraft." The shipper, or his authorized agent, shall sign the statement. The person operating an aircraft may rely on the shipper's statement as prima facie evidence that the shipment complies with the requirements of this part.

(b) The shipper shall execute the required certificates in duplicate. One signed copy accompanies the shipment and the originating air carrier retains the other signed copy.

(C) By amending § 103.7 to read as follows:

Passenger-carrying aircraft.

person may carry any dangerous article in a passenger-carrying aircraft except—

(a) Articles specified by 49 CFR 172.5 as exempted from the specification packing, marking, and labeling requirements of 49 CFR Parts 172, 173, and 178, when those articles are shipped as required for the exemption; and

(b) The following articles when packed, marked, and labeled as specifically provided in 49 CFR Parts 171 through 178 for shipment by rail express:

(1) Small arms ammunition and practice cartridge ammunition.

(2) Class C explosives, other than those permitted under subparagraph (1) of this paragraph, with a net weight of not more than 50 pounds in each outside container.

(3) Subject to § 103.19(a), non-flammable compressed gases, except anhydrous ammonia, boron trifluoride, chlorine, hydrogen bromide, hydrogen chloride, nitrosyl chloride, and sulfur dioxide.

(4) X-ray film with a nitrocellulose base and motion picture film, either exposed or unexposed.

(5) Pyroxylin plastics containing nitrocellulose, in sheets, rolls, rods, or tubes.

(6) Subject to § 103.19(b), radioactive materials other than liquids, which do not bear a radioactive yellow III label are listed in 49 CFR 172.5 as acceptable for shipment by rail express.

) By amending § 103.9 to read as follows:

§ 103.9 Cargo aircraft.

(a) No person may carry any dangerous article in a cargo aircraft except those articles permitted on passenger-carrying aircraft under § 103.7, and except articles that:

(1) Are specified in 49 CFR 172.5 as acceptable for shipment by rail express;

(2) Do not exceed the maximum quantity for each outside container specified in 49 CFR 172.5 for rail express; and

(3) Have been certified by the shipper as acceptable for shipment by rail express under the specific requirements of 49 CFR Parts 171 through 178.

(b) For the purposes of this part, a cargo aircraft is any aircraft that is not a passenger-carrying aircraft.

(E) By amending § 103.19(b) to read as follows:

§ 103.19 Quantity limitations.

(b) No person may carry aboard an aircraft a number of packages of radioactive materials that makes the total transport index number (determined by adding together the transport index numbers shown on the labels of the individual packages) more than 50.

(F) By canceling § 103.21.

§ 103.21 [Canceled]

(G) By amending § 103.23 to read as follows:

§ 103.23 Special requirements for radioactive materials.

(a) No person may place packages of radioactive materials bearing "radioactive yellow" or "radioactive yellow-III" labels in aircraft closer than the distances shown in the following table to a space (or dividing partition between spaces) which may be continuously occupied by people, or shipments of animals, or closer than the distances shown in the following table to any package containing undeveloped film (if so marked). If more than one of these packages is present, the distance shall be computed from the following table on the basis of the total transport index numbers shown on the labels of the individual packages in the aircraft:

Total transport index	Minimum separation distances in feet to nearest undeveloped film for various times of transit					Distances in feet to area of passengers or employees, or distance in feet from dividing partition of cargo compartments
	Up to 2 hours	2-4 hours	4-8 hours	8-12 hours	Over 12 hours	
None.....	0	0	0	0	0	0
0.1-1.0.....	1	2	3	4	5	1
1.1-5.0.....	3	4	6	8	11	2
5.1-10.0.....	4	6	9	11	15	3
10.1-20.0.....	5	8	12	16	22	4
20.1-30.0.....	7	10	15	20	29	5
30.1-40.0.....	8	11	17	22	33	6
40.1-50.0.....	9	12	19	24	36	7

(b) In case of fire, wreck, breakage, or unusual delay involving shipments of radioactive materials, the operator of the aircraft shall immediately notify the shipper and the Department. Aircraft in which radioactive materials have been spilled may not be again placed in service or routinely occupied until decontaminated by qualified persons, so that at any accessible surface the radiation dose rate is less than 0.5 millirem per hour and there is no significant removable radioactive surface contamination.

Note 1: In these instances, the package or materials should be segregated as far as practicable from personnel contact. If radiological advice or assistance is needed, the U.S. Atomic Energy Commission should also be notified. In case of obvious leakage, or if it appears likely that the inside container may have been damaged, care should be taken to avoid inhalation, ingestion, or contact with the radioactive materials. Any loose radioactive materials should be left in a segregated area pending disposal instructions from qualified persons.

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